WEST Search History

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DATE: Monday, March 22, 2004

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		DB=USPT,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR	
☐	L7	((channel$ or frequenc$3) near3 hop$4) and ((verif$4 or handshak$3) near3 (channel$ or frequnec$3)) and (quality near3 (measur$5 or detect$3))	9
☐	L6	((channel$ or frequenc$3) near3 hop$4) and ((handshak$3) near3 (channel$ or frequnec$3)) and (quality near3 (measur$5 or detect$3))	1
☐	L5	((channel$ or frequenc$3) near3 hop$4) same ((handshak$3) near3 (channel$ or frequnec$3))	4
☐	L4	(frequenc$3 near3 hop$4) same ((hand adj2 shak$3) near3 (channel$ or frequnec$3))	0
☐	L3	(frequenc$3 near3 hop$4) same (handshak$3 near3 (channel$ or frequnec$3))	1
☐	L2	(frequenc$3 near3 hop$4) and (soft near2 handoff) and (hard near2 handoff)	13
☐	L1	(frequenc$3 near3 hop$4) same (soft near2 handoff) same (hard near2 handoff)	0

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L6: Entry 1 of 1 File: USPT Oct 8, 2002

DOCUMENT-IDENTIFIER: US 6463290 B1
**** See image for Certificate of Correction ****
TITLE: Mobile-assisted network based techniques for improving accuracy of wireless location system

Detailed Description Text (18):
When a wireless transmitter makes a transmission, the Wireless Location System must receive the transmission at multiple SCS's 10 located at multiple geographically dispersed cell sites. Therefore, each SCS 10 has the ability to receive a transmission on any RF channel on which the transmission may originate. Additionally, since the SCS 10 is capable of supporting multiple air interface protocols, the SCS 10 also supports multiple types of RF channels. This is in contrast to most current base station receivers, which typically receive only one type of channel and are usually capable of receiving only on select RF channels at each cell site. For example, a typical TDMA base station receiver will only support 30 KHz wide channels, and each receiver is programmed to receive signals on only a single channel whose frequency does not change often (i.e. there is a relatively fixed frequency plan). Therefore, very few TDMA base station receivers would receive a transmission on any given frequency. As another example, even though some GSM base station receivers are capable of frequency hopping, the receivers at multiple base stations are generally not capable of simultaneously tuning to a single frequency for the purpose of performing location processing. In fact, the receivers at GSM base stations are programmed to frequency hop to avoid using an RF channel that is being used by another transmitter so as to minimize interference.

Detailed Description Text (131):
The Wireless Location System also uses these means for voice channel transmissions. For all triggers contained in the Tasking List, the Wireless Location System monitors the prescribed interfaces for messages pertaining to those triggers. The messages of interest include, for example, voice channel assignment messages, handoff messages, frequency hopping messages, power up/power down messages, directed re-try messages, termination messages, and other similar action and status messages. The Wireless Location System continuously maintains a copy of the state and status of these wireless transmitters in a State Table in the AP 14. Each time that the Wireless Location System detects a message pertaining to one of the entries in the Tasking List, the Wireless Location System updates its own State Table. Thereafter, the Wireless Location System may trigger to perform location processing, such as on a regular time interval, and access the State Table to determine precisely which cell site, sector, RF channel, and timeslot is presently being used by the wireless transmitter. The example contained herein described the means by which the Wireless Location System interfaces to a GSM based wireless communications system. The Wireless Location System also supports similar functions with systems based upon other air interfaces.

Detailed Description Text (162):
A further enhancement of the present invention, used for both central based processing and station based processing, is the use of threshold criteria for including baselines in the final determination of location and velocity of the wireless transmitter. For each baseline, the Wireless Location System calculates a number of parameters that include: the SCS/antenna port used with the reference

SCS/antenna in calculating the baseline, the peak, average, and variance in the power of the transmission as received at the SCS/antenna port used in the baseline and over the interval used for location processing, the correlation value from the cross-spectra correlation between the SCS/antenna used in the baseline and the reference SCS/antenna, the delay value for the baseline, the multipath mitigation parameters, the residual values remaining after the multipath mitigation calculations, the contribution of the SCS/antenna to the weighted GDOP in the final location solution, and a measure of the quality of fit of the baseline if included in the final location solution. Each baseline is included in the final location solution is each meets or exceeds the threshold criteria for each of the parameters described herein. A baseline may be excluded from the location solution if it fails to meet one or more of the threshold criteria. Therefore, it is frequently possible that the number of SCS/antennas actually used in the final location solution is less than the total number considered.

Detailed Description Text (251):
According to this method, upon an appropriate trigger, the mobile phone scans the carrier spectrum and determines whether to overlay the wideband signal on the AMPS RECC or on unoccupied channels in the 1900 MHz band. The mobile phone then transmits an RDATA L3 message indicating to the WLS the intended channels to use for transmission. (RDATA L3 is a generic name for an RDATA message, defined in the IS136 TDMA specification, that transmits a layer 3 type of message.) If AMPS RECC is selected, the mobile phone transmits an invalid AMPS RECC burst immediately followed by the wideband signal. Then the mobile unit returns to normal call processing. If unoccupied spectrum is selected, the mobile phone still transmits an invalid AMPS RECC burst in the unoccupied spectrum immediately followed by the wideband signal. The mobile phone will employ logic permitting it to transmit in the unoccupied spectrum even though no formal channels are present for normal handshake.

L3: Entry 1 of 1 File: USPT Jan 2, 2001

DOCUMENT-IDENTIFIER: US 6169761 B1
TITLE: Method and transceiver using an improved protocol for a frequency hop communication system

Abstract Text (1):
A frequency hopping transceiver having a protocol for selecting a clear channel for exchanging QAM payload data signals. An energy level in a current channel is sounded by to determine whether it is clear or busy. When the current channel is clear an outgoing frequency shift key (FSK) handshake signal is transmitted. When the current channel is busy or an incoming handshake signal is not received, the transceiver hops to the next channel without waiting until the dwell time has elapsed for the current channel. When a channel is clear and the FSK handshake signal is received the transceiver uses a differential synchronization time for exchanging QAM acquisition signals and payload data in unison.

Detailed Description Text (28):
FIG. 5 is a flow chart of the rendezvous protocol used by the rendezvous protocol code 160 for establishing a communications link. In a step 252 the master transceiver selects a frequency channel pair from the frequency hop table 180. In a step 258 the master transceiver determines whether or not the transmit frequency of the channel is clear or busy as illustrated in FIG. 4b and described in the accompanying detailed description. When the channel is busy, the master transceiver returns to the step 252 for selecting the next channel pair and so on until a channel is found that is clear. In a step 260 when a clear channel has been found, the master transceiver transmits rendezvous handshake signals on its transmit channel frequency at a repetition of about two milliseconds for a relatively long time until a time out occurs at about three hundred milliseconds. The handshake signals include a time stamp for the time that the signals are transmitted and an identification of the slave transceiver for which the signals are intended. In a preferred embodiment the identification is the serial number of the indoor unit 24 of the slave transceiver. Simultaneously, the master transceiver listens on its receive frequency for a responsive handshake signal from the slave transceiver. In a step 262 when the time out occurs before the responsive handshake signal is received from the slave transceiver, the master transceiver returns to the step 252 for selecting the next channel pair and so on until a channel is found that is clear and the responsive handshake signal is received.

Detailed Description Text (29):
Asynchronously, in a step 264 the slave transceiver selects a channel pair from the frequency hop table 180. In general, the channel pair first selected by the slave transceiver will be different than the first channel pair selected by the master transceiver. In a step 266 the slave transceiver listens on the receive frequency for the handshake signal having its identification for a relatively short time of about thirty milliseconds until a time out occurs. In a step 268 when the time out occurs before the handshake signal is received, the slave transceiver returns to the step 264 for selecting the next frequency channel pair and so on until a channel is found where the handshake signal is received.

Detailed Description Text (40):
In a step 512 the slave transceiver uses the frequency hop table 180 for selecting

the same channel having the IF transmit and receive frequencies and RF bands reversed. In a step 518 the slave transceiver determines whether or not the receive frequency of the channel is clear or busy as illustrated in FIG. 4b and described in the accompanying detailed description. When the channel is busy, the slave transceiver returns to the step 512 for selecting the next frequency channel pair and so on until a channel is found that is clear. In a step 520 when a clear channel has been found, the slave transceiver listens on its receive frequency for the handshake signals from the master transceiver. In a step 522 when a time out of about five milliseconds occurs before the handshake signal is received, the slave transceiver returns to the step 512 for selecting the next channel without waiting for the specified dwell time to elapse, and so on until a channel is found that is clear and the handshake signal is received. In a step 524 when the handshake signal is received, the slave transceiver begins a differential synchronization time of about seven times the transmit time FSKTD after receiving the handshake signal before transmitting and expecting to receive QAM acquisition signals. If no handshake signal is received after successively trying about ten clear channels, the slave transceiver returns to the step 264 (FIG. 5) in the rendezvous protocol.

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L5: Entry 2 of 4 File: USPT Apr 8, 1997

DOCUMENT-IDENTIFIER: US 5619530 A
TITLE: Method and apparatus for detecting and handling collisions in a radio communication system

Detailed Description Text (3):
In the preferred embodiment, the transceivers 12, 13, 14, 15, 17 operate in a short range decentralized communication system 10 on communication channels under a channel hopping protocol. Other channel sharing protocols may be used which incorporates the concepts of the present invention. The communication channels comprise a plurality of frequencies organized into a sequence of frequency channels. The communication channel may comprise one or more frequency channels, such as a transmit and receive frequency pair or a similar grouping. As mentioned earlier, there is no infrastructure to govern channel allocation and use. However, each transceiver 12, 13, 14, 15, 17 is capable of establishing communication links within the system 10, including deciding which communication channel to use and at what time. In the preferred embodiment, communication links are established asynchronously on an acquisition communication channel, and once established, handshaking occurs between the initiating transceivers 12, 14 and target transceivers 13, 15 to enable further communications. The present invention provides a protocol which allows the initiating transceivers 12, 14 and target transceivers 13, 15 to cooperate in detecting and resolving a collision occurring while attempting to access the acquisition communication channel.

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L9: Entry 4 of 7 File: USPT Nov 28, 1995

DOCUMENT-IDENTIFIER: US 5471469 A
**** See image for Certificate of Correction ****
TITLE: Method of resolving media contention in radio communication links

Abstract Text (1):
In a wireless packet communication system having a plurality of nodes, each having a transmitter and a receiver, the receiver at each node is assigned a specific frequency hopping band plan on which to receive signals, and the transmitter of any source node desiring to communicate with a target node changes frequency to the frequency of the target node according to the band plan. Thereupon, the source node transmits a poll packet which polls the target node to determine whether the target node is able and willing to accept a specified number of packets, at a specified level of priority. A failure to receive an acknowledgement on the source node's receive channel is a prompt to the source node either to retransmit a polling packet later, to change the polling packet or to redirect the polling packet to another target. In the event the target node returns an acknowledgement, the target node reserves access to itself for the polling station at a determined time for a determined duration. The source node then transmits its data packet on the target node receive channel and waits for an acknowledgement on its own receive channel. The source node and the target node exchange information on the agreed upon data exchange channel, even though the expected receive channel according to the frequency hopping band play of the target node may have changed in the meantime.

Brief Summary Text (16):
According to the invention, in a wireless LAN packet communication system having a plurality of nodes, each having a transmitter and a receiver, the receiver at each node is assigned a specific frequency hopping band plan on which to receive signals. The frequency of the receive channel "hops" from one frequency to the next according to the band plan at specified intervals and the channel hopping band plan of each receiver node is known to all nodes in the network. The transmitter of any source node desiring to communicate with a target node changes its frequency to follow the band plan of the receiver of the target node. Thereupon, the source node transmits a poll packet that polls the target node to determine whether the target node is able and willing to accept a specified number of data packets at a specified level of priority. A failure to receive an acknowledgement on the source node's receive channel is a prompt to the source node either to retransmit a polling packet later or to redirect the polling packet to another target. In the event the target node returns an acknowledgement, the target node reserves access to itself for the polling station at a preselected time for a preselected duration on a specified frequency channel that is different from the assigned channel according the band plan for the target node. The source node then transmits its data packet on the target node's data receive channel and waits for an acknowledgement on its own receive channel. The source node and the target node exchange information on the same channel throughout the interchange, even though the assigned receive channel of the target node may have changed in the meantime.

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L10: Entry 3 of 4 File: USPT Nov 28, 1995

DOCUMENT-IDENTIFIER: US 5471469 A
**** See image for Certificate of Correction ****
TITLE: Method of resolving media contention in radio communication links

Abstract Text (1):
In a wireless packet communication system having a plurality of nodes, each having a transmitter and a receiver, the receiver at each node is assigned a specific frequency hopping band plan on which to receive signals, and the transmitter of any source node desiring to communicate with a target node changes frequency to the frequency of the target node according to the band plan. Thereupon, the source node transmits a poll packet which polls the target node to determine whether the target node is able and willing to accept a specified number of packets, at a specified level of priority. A failure to receive an acknowledgement on the source node's receive channel is a prompt to the source node either to retransmit a polling packet later, to change the polling packet or to redirect the polling packet to another target. In the event the target node returns an acknowledgement, the target node reserves access to itself for the polling station at a determined time for a determined duration. The source node then transmits its data packet on the target node receive channel and waits for an acknowledgement on its own receive channel. The source node and the target node exchange information on the agreed upon data exchange channel, even though the expected receive channel according to the frequency hopping band play of the target node may have changed in the meantime.

Brief Summary Text (16):
According to the invention, in a wireless LAN packet communication system having a plurality of nodes, each having a transmitter and a receiver, the receiver at each node is assigned a specific frequency hopping band plan on which to receive signals. The frequency of the receive channel "hops" from one frequency to the next according to the band plan at specified intervals and the channel hopping band plan of each receiver node is known to all nodes in the network. The transmitter of any source node desiring to communicate with a target node changes its frequency to follow the band plan of the receiver of the target node. Thereupon, the source node transmits a poll packet that polls the target node to determine whether the target node is able and willing to accept a specified number of data packets at a specified level of priority. A failure to receive an acknowledgement on the source node's receive channel is a prompt to the source node either to retransmit a polling packet later or to redirect the polling packet to another target. In the event the target node returns an acknowledgement, the target node reserves access to itself for the polling station at a preselected time for a preselected duration on a specified frequency channel that is different from the assigned channel according the band plan for the target node. The source node then transmits its data packet on the target node's data receive channel and waits for an acknowledgement on its own receive channel. The source node and the target node exchange information on the same channel throughout the interchange, even though the assigned receive channel of the target node may have changed in the meantime.

Brief Summary Text (17):
While data is being received by the target node, it is simply unavailable at its assigned frequency. Other nodes that attempt to send it a polling packet at its assigned frequency will not get an acknowledgement and will either wait or send the

packet to a different target. An advantage of the invention is that these polling packets will not clash with data being received by the target node, because that data is being received on a different frequency. When the data transfer is complete, the receive node switches back to its assigned channel according to its frequency hopping band plan and is ready to receive a polling packet for any transmitter that is looking for it at its assigned channel.

Detailed Description Text (3):
During the time from T4 to T12, the receiver is not available at its frequency hopping band plan assigned frequencies F4 to F12. Any other transmitter that sends a polling packet requesting availability of the receiver will do so on frequencies F4-F12 and will not receive a response and will therefore know that the receiver is unavailable. These polling packets will not cause contention with the data being received by the receiver, because the receiver has remained at frequency F3 to receive data packets. As soon as the data transmission is complete, the receiver switches to its assigned frequency according to its frequency hopping band plan and is ready to again receive a polling packet. In this way, the receiver's available time is taken up just so long as is necessary to transmit the data, and contention between data packets and polling packets are avoided.

Detailed Description Text (5):
FIG. 3 is a flowchart illustrating the operation of a transmitting node. The transmitter first switches to the assigned frequency of the receiver to which it wishes to transmit (Step T1). It then listens at that frequency channel to determine if the frequency is silent (Step T2). If the channel is silent, the transmitter transmits a polling packet to the receiver (Step T3). The transmitter then listens to see if an acknowledgement is received (Step T4). If no acknowledgement is received or if the channel was not silent, the transmitter determines if there is another node to which it may transmit the packet that will get the packet to its ultimate destination (Step T5). If there is no other node available to move the packet closer to its ultimate destination, the transmitter waits (Step T6) and then retransmits a polling packet to the same receiver at its new assigned frequency (Step T5). If an acknowledgement is received, the transmitter transmits the data packets (Step T7).

Detailed Description Text (7):
In a specific embodiment of the protocol of the invention, the receiver and transmitter may not transmit on any one frequency channel for more than 400 ms so as to comply with regulations of the United States Federal Communication Commission. If the data transmission is of longer duration than this, the transmitter and receiver will switch to another frequency channel which is not the current assigned frequency channel, such as the numerically next frequency channel, and remain there until the data is transmitted.

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L3: Entry 4 of 8 File: USPT Nov 3, 1998

DOCUMENT-IDENTIFIER: US 5832026 A
TITLE: Method for correcting errors from a fading signal in a frequency hopped spread spectrum communcation system

Primary Examiner (1):
Bocure; Tesfaldet

NO

Detailed Description Text (2):
Referring to FIG. 1, a selective call system (selective call communication system) is shown as a frequency-hopped (FH) spread spectrum selective call system 10 illustrating a base site terminal 150 and a selective call device 100 in accordance with the preferred embodiment of the present invention. The selective call terminal 150 comprising a terminal controller 152 coupled to a base site transceiver 156. The terminal controller 152 receives messages from an input device, for example a telephone, computer or an alpha-entry device or the like (not shown) and via the transceiver 156 and antenna 154 transmits the messages to the selective call device 100. A received message (or information) is processed by encoding the message with an address designating the selective call device 100 as is well known in the art. The encoded message is then passed to the antenna 154 which transmits (or receives) radio frequency (RF) message to (or from) the selective call device 100. The transceiver 156 is coupled with or comprises a mixer or a frequency convertor 158 well known in the art. The mixer 158 is coupled to a frequency synthesizer 160 for enabling the transceiver 156 to tune or select a plurality of frequencies to receive (or transmit) selective call message on the plurality of frequencies. As is well known, a frequency hopped spread spectrum communication system hops (or switches) to the plurality of frequencies where portion of the message or information is transmitted and/or received. A pseudo random (PN) sequence generator 162 generates a sequence of numbers under the control of a time synchronizer 164 which is synchronized with an PN generator of a transmitter in the selective call device. The values of the sequence that are generated by the PN sequence generator 162 are used by the frequency synthesizer 160 and the mixer or a frequency convertor 158 to tune the transceiver to the different frequencies (or hops) of the frequency hopped spread spectrum signal where different portions of the message are transmitted in each of a plurality of hops.

Detailed Description Text (3):
In a frequency-hopped (FH) spread spectrum communication system, the information is transmitted and received over a wide band frequency, e.g., the Industrial, Scientific and Medical (ISM) band. There are three ISM bands, 902-928 MHz, 2400-2483.5 MHz and 5725-5850 (MHz). For selective call reverse channel, it is preferred to operate at 902-928. However, applications of the invention is not limited to this band. As is well known, a frequency hopped communication system uses a spread spectrum technique because the data-modulated carrier hops from one narrow-band-frequency channel to another frequency randomly within a specified wideband frequency. Those frequency hoppings are controlled by a random sequency generator to enable frequency hopping over a plurality of narrow band channels. A corresponding receiver is capable of duplicating the same random sequency as well as the random carriers. In the FH spread spectrum system, Forward Error Correction (FEC) is always important. With the FEC, the message that is recoverable by FEC when some of random channels (or carriers) are jammed by interferences and/or

fading. Two basic characters of FH systems are Slow-frequency hopped (SFH) and Fast-frequency Hopped (FFH). The SFH system transmits several symbols in each frequency hop and the FFH system will hop several times during the transmission of one symbol.

Detailed Description Text (4):
Referring to FIG. 2, a graphic representation is shown illustrating an example of particular frequency hopped pattern in a time-frequency plane. The graph is an example of the frequency hops and the time slots of each hop. The wide band frequency is sub-divided into a plurality of contiguous frequency slots (1-6) over the time intervals (Tc-to-6Tc). For example, in a signaling interval, the transmitted signal occupies one or more of the available frequency slots preferably one frequency slot. The selection of the frequency slot corresponds to the signaling intervals (Tc-6Tc), and are made pseudo-randomly according to the output from the PN sequence generator 162. The frequency synthesizer 160 generates a number corresponding to one of the frequency hop during an appropriate time interval, e.g., Tc, which causes the mixer a frequency convertor 158 to tune to the narrow band frequency slot, e.g., frequency slot or hop 1, to receive the information being transmitted. After the information is received during frequency hop 1, the PN generator 162 generates the next number which causes the frequency synthesizer 160 and the mixer a frequency convertor 158 to tune the transceiver 156 to the next frequency hop 2 during time interval, 2Tc. The PN generator 162 under the control of the time synchronizer 164 continues to generate numbers to cause the frequency synthesizer 160 and the mixer a frequency convertor 158 to tune to, e.g., the other frequency slots 3-6 corresponding to time intervals 3Tc-6Tc. The transceiver 156 receives the information transmitted during the plurality of frequency hops of the frequency hopped spectrum system to receive the information or message that is transmitted by the selective call device. The message or information is stored in memory 166.

Detailed Description Text (5):
The selective call device 100 (e.g., a selective call receiver with an acknowledge back transmitter) transmits an inbound signal as a frequency hopped (FH) signal in response to the receipt of a message from the base site terminal 150. The outbound signal from the base site terminal can be received on any other signaling protocol, preferably the FLEX.TM. protocol. The inbound signal bandwidth for each hop is equal to bandwidth of M-ary FSK modulated signal. The inbound FH signal, according to the preferred embodiment, is modulated as a four-level frequency shift keying (4FSK) signal and encoded as a Reed Solomon code word "RS (15, 5)". The designed system employs the 4FSK at 400 symbols per second (800 bits-per-seconds). Preferably, the signal bandwidth for each hop is 3.125 KHz. The preferred message length of the selective call reverse channel is 80 bits. Every 20 bits are encoded in to a (15,5) Reed-Solomon code word, RS(15,5). There are total 4 code words for each message. Reed-Solomon code is well known in the art as a non-binary Bose Chaudhuri-Hocquenghem (BCH) code. It is well known that other code words could be used as well. The RS(N, K) is a code that encodes K information symbols into a code word with N symbols. The N symbols are equal (N)=2 m-1 in which m is number of bits in each symbol. The RS code word can correct a total number of errors (t), and number of erasures (e), if 2t+e is less than (N-K)+1. An error is defined as a transmission error whose both location and value are unknown, and an erasure is defined as an error whose location is known but whose value is unknown. For example, an RS(15,5) code word has total 15 symbols in which 5 are information symbols. Each symbol has 4 bits. The RS(15,5) code word can correct a 5 symbol errors without any erasure. However it can correct up to 10 transmission errors if they are correctly marked as erasures. The increase capability is obtained because the location of the errors are known.

Detailed Description Text (18):
Referring to FIG. 8, a flow diagram is shown illustrating the operation of the terminal controller determining when a channel is jammed by an interference. When a

signal is received by the receiver at the base site, the FH demodulator demodulates the FH data from the plurality of frequency hops, step 800. As is well known, the demodulated data is sampled and then passed to the FFT for converting the time-domain signal to a frequency-domain signal, step 802. From the magnitude or energy values corresponding to the samples from the FFT, the offsets corresponding to the 4FSK symbol, k=0-3, are selected based upon the frequency deviation of the 4FSK, step 804. A matrix representation of the data is generated and stored as a matrix, step 806. The matrix has a eight rows and four columns, the eight rows correspond to the number of bits of each row of the interleaved matrix of FIG. 4 and the four columns correspond to the number of 4FSK offsets or frequency deviations, k=0-to-3. The difference between adjacent rows of the matrix are computed for each of the k=0-3 indexes [d.sub.j,k =abs (f.sub.j,k -f.sub.j-1,k,)], step 808. The differences are summed for the k=0-3 indexes along the rows of the matrix [U.sub.k =.SIGMA.d.sub.j,k for j=1 to 8 at k=0-3], step 810. The total energy of each column of the matrix is computed by adding or summing the magnitude or energy of each indexes, [V.sub.k =.SIGMA.f.sub.j,k for j=0 to 7 at k=0-3], step 812. The column that has the maximum energy value is identified or determined as the column with the maximum energy, k.sub.max, step 814. The sum of the difference is divided by the maximum energy of the column, [W=Uk.sub.max /Vk.sub.max], step 816. A predetermined threshold value is set as a jamming threshold, Tj, to 0.5, step 818. If the sum of the difference divided by the maximum energy value of the column, W, is greater that the jamming threshold, Tj, then the row had not experienced a jamming signal during transmission, step 820. The corresponding value is set to zero, step 824, and that value is written to a jamming matrix, step 826. When the sum of the difference is divided by the maximum energy, W, is greater than or equal to the jamming threshold, Tj, step 820, the value is set to one and the result is written to a jamming matrix, step 820. The result is repeated until all the data has been processed and a matrix is generated with the RS symbols are marked as having a high probability of being in error.

Detailed Description Text (20):
Referring to FIG. 10, a flow diagram is shown illustrating the operation of the terminal controller for determining when a channel is in a fade in accordance with the preferred embodiment of the present invention. When a signal is received by the receiver at the base site, the FH demodulator demodulates the FH data from the plurality of frequency hops, step 1000. As is well known, the demodulated data is sampled and then passed to the FFT for converting the time-domain signal to a frequency-domain signal, step 1002. From the magnitude or energy values corresponding to the samples from the FFT, the offsets corresponding to the 4FSK symbol, k=0-to-3, are selected based upon the frequency deviation of the 4FSK symbol, step 1004. A matrix representation of the data is generated and stored as a matrix, step 1006. The matrix has a eight rows and four columns, the eight rows correspond to the number of bits of each row of the interleaved matrix of FIG. 4 and the four columns correspond to the number of 4FSK offsets or frequency deviations, k=0-to-3. The maximum energy or magnitude value and the next largest energy or magnitude value of the frequency deviations are determined for each row of the matrix, and the ratio of the maximum energy to the next largest energy is determined, Sj, step 1008. A predetermined threshold is set or established as the eye-opening threshold value equal to 1.2, step 1012. In step 1012, when the ratio is determined to be greater than the eye-opening threshold (1.2), the ratio is set to 1, step 1014. Alternatively, when the ratio is determined to be less than the eye-opening threshold, step 1012, the ratio is set to zero, step 1016.

Detailed Description Text (28):
As set forth, the inbound channel of the selective call system will operate in the ISM band which was approved for frequency hopped spread spectrum communication systems. It is anticipated that there will be numerous other systems operating in the ISM band which will cause interference, therefore this method and apparatus will correct any errors resulting from fading signals or random-type errors.

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L10: Entry 1 of 4 File: USPT Jun 17, 1997

DOCUMENT-IDENTIFIER: US 5640415 A
TITLE: Bit error performance of a frequency hopping, radio communication system

Abstract Text (1):
The technique of redundantly retransmitting digitized voice data on multiple sequential frequencies increases the channel bit rate above the minimum required for normal communication in a frequency-hopping communication system for digitized voice signals. Digitized voice data is redundantly retransmitted on multiple sequential frequencies and the channel bit rate is increased above the minimum required for normal communication. Repeated transmissions of the same block of digitized voice data occurs n times at n times the bit rate of the original digitized voice data. A frequency-hopping transmitter transmits on different channels, or carrier frequencies, which are modulated by the digitized voice data signals from a transmitter data buffer. A receiver data buffer holds n blocks of digitized voice data. A signal quality estimator estimates which of the n blocks of digitized voice data has a desirable signal quality and selects the block of digitized voice data having the desirable signal quality at an output terminal of the system.

Brief Summary Text (11):
In accordance with this and other objects of the invention, a frequency-hopping communication system and method is provided for digitized voice signals. The system includes means for redundantly retransmitting digitized voice data on multiple sequential frequencies and means for increasing the channel bit rate above the minimum required for normal communication. The invention takes advantage of this redundant retransmission of digitized voice data on multiple sequential frequencies and increasing the channel bit rate above the minimum required for normal communication to provide improved bit error performance, guaranteed data throughput.

Detailed Description Text (18):
The received data information for each sequentially transmitted block are respectively stored in a parallel receiver buffer arrangement 164, which includes four buffers 164a, 164b, 164c, 164d each of which has a length of 1 block of digitized voice data. An input selection switch 166 has an input terminal 166.sub.in and four output terminals 166a, 166b, 166c, 166d. The switch is operated in synchronization with the channel selector 162 so that the input terminal 166in is connected to a respective output terminal 164a, 164b, 164c, 164d. In this manner, the data block B.sub.1,1 is fed into the buffer 164a; the data block B.sub.1,2 is fed into the buffer 164b; the data block B.sub.1,3 is fed into the buffer 164c; and the data block B.sub.1,4 is fed into the buffer 164d.

Detailed Description Text (23):
If the original system uses 208 different frequencies, which are distributed over a service band, the bandwidth allocated for these frequencies will provide 52 channels for a time-compressed, retransmission system according to the invention. For a retransmission system according to the invention, each block of input data uses 4 channels covering 16 of the original frequency bands, so that 13 blocks of data can be retransmitted using the frequency bandwidths allocated for the 208 different frequencies of the service bandwidth. Each channel has a bandwidth

covering 4 of the original frequencies used in the prior art system. If certain ones of the 208 frequency bands are corrupted by interference, we assume that the digitized voice data transmitted through a channel encompassing one of these corrupted frequencies will be in error and not useful for reproduction of a voice signal. The bandwidths associated with each of these 208 frequencies is periodically used by frequency hopping systems. A frame of data is one block of original data. A block of digitized voice signals may include, if appropriate, parity/error detection bits or other system overhead bits.

Detailed Description Text (33):
FIG. 6 is a block diagram of an alternative embodiment of a frequency-hopping radio system 200 for voice communication according to the invention. In this embodiment block retransmission of a block of data occurs using several different frequencies in a manner similar to that described in connection with FIG. 3 herein above.

Detailed Description Text (41):
Referring to FIG. 6, the signal quality estimator circuit 240 operates as follows: When block B.sub.11 is being received, the switches are in positions A.sub.in /A.sub.out. When block B.sub.12 is being received, the switches are in positions B.sub.in /B.sub.out. When block B.sub.13 is being received, the switches are set to positions A.sub.in /A.sub.out if the quality of the signal for the contents of Buffer A is less than the quality of the signal for the contents of Buffer B, otherwise the switches are in positions B.sub.in /B.sub.out. When block B.sub.14 is being received, the switches are set to positions A.sub.in /A.sub.out if the quality of the signal for the contents of Buffer A is less than the quality of the signal for the contents of Buffer B, otherwise the switches are in positions B.sub.in /B.sub.out. The switches are operated in synchronization with the channel selector 212. The frequencies of the receiver frequency selector circuit 112 are coordinated with the transmitter frequencies according to a frequency-hopping protocol.

CLAIMS:

1. A frequency-hopping communication system for digitized voice signals, comprising:

means for repeatedly retransmitting n times a block of digitized voice data on multiple sequential frequencies at n times the original bit rate of the digitized voice data;

means for estimating at a frequency hopping receiver the signal quality of each retransmitted block of digitized voice data;

multiplexed receiver data buffer means for holding n blocks of digitized voice data from the frequency-hopping receiver; and

means for selecting the retransmitted block having the best quality.

2. A frequency-hopping communication system for digitized voice signals, comprising:

transmission means for repeatedly retransmitting the same block of digitized voice data n times at an increased bit rate over the original block bit rate where each transmission of the same block of digitized voice data is retransmitted on a different carrier frequency, and where said transmission means includes a frequency-hopping transmitter, which transmits on different predetermined carrier frequencies and which is modulated by the digitized voice data signals from a transmitter data buffer means, and which provides output transmitted signals;

receiver means for receiving the output transmitted signals from the frequency-

hopping transmitter;

receiver data buffer means for holding n blocks of digitized voice data from the frequency-hopping receiver;

signal quality estimator means for estimating which of the n blocks of digitized voice data has a desirable signal quality; and

means for providing the block of digitized voice data having the desirable signal quality at an output terminal of the system.

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L10: Entry 4 of 4 File: USPT Oct 23, 1984

DOCUMENT-IDENTIFIER: US 4479215 A
TITLE: Power-line carrier communications system with interference avoidance capability

Detailed Description Text (2):
Referring initially to FIG. 1, I have recognized that a substantial portion, if not all, of the noise on a power-line communications medium is man-made, is correlated, and is typically in the form of carriers from other communication systems. Accordingly, a power-line-carrier (PLC) communications system which dynamically avoids bands of interference, by slow frequency hopping of the carrier signal, will be of advantage. The PLC system utilizes a plurality of transmitting/receiving stations 10, each connected to the common power-line communications medium 11. Each station 10 includes a highly stable master oscillator means 12 producing a signal at a reference frequency f.sub.r. The reference frequency is utilized in a transmission-frequency synthesizing means 14 to provide a transmission frequency f.sub.t signal which is then modulated, as by binary digital data and the like, in a transmitter means 15. The modulated signal is coupled from a station transmitter output port 10a to the system transmission medium 11. The reference frequency f.sub.r from oscillator means 12 is also utilized in a reception-frequency synthesizing means 16 for generation of a local oscillator frequency f.sub.lo. The local oscillator signal is supplied to a PLC receiving means 18 for facilitating reception of a PLC signal present at a reception input 10b from the system medium 11. Each data packet provided at the transmission data input 15a of means 15 is provided with error detection coding bits, so that transmission errors can be detected in a receiving unit 18 of a recipient station 10. Each data packet transmitted requires an acknowledgement, as by a return message introduced at transmitter input 15b, upon receipt by the intended receiving station 10. In the absence of an acknowledgement of receipt (ACK) signal, the transmitting station 10 will retransmit the data packet until the first occurring one of: receipt of an ACK signal, or a predetermined number of transmissions without receipt of the ACK signal. If a data packet is transmitted the predetermined number of times without receipt of the ACK signal, the transmitting station then receives, at input 15c, a command to be transmitted over medium 11 to all stations 10 in the system. The command causes all stations 10 to change frequency to the next frequency in a pre-established sequence containing a plurality K of operating frequencies. The packet is retransmitted thereafter. If the packet is still not received and acknowledged, the transmitting station again sends a system-wide frequency-change message and again attempts to transmit the original message. If the ACK signal is not received after cycling through the entire set of the plurality of predetermined frequencies, all stations 10 return to the initial frequency and wait until the system noise characteristics alter such that communication can be resumed. Advantageously, the signal utilized to command all stations in the system to advance to the next predetermined frequency is caused to resemble the most likely interference signal expected, so that the presence of such interference will itself cause a change in system frequency, thereby avoiding that most likely interference signal in the event that communication is wiped out (as evidenced by lack of receipt of an AOR signal). Accordingly, each of the plurality of stations 10 includes a frequency-change controlling means 20 for determining which of the predetermined plurality of operating frequencies is to be synthesized by means 14 and 16 and thus determine the operating frequency of each of stations 10.

CLAIMS:

4. The system of claim 3, wherein each receiving means includes a common intermediate-frequency amplifier; a mixing means, receiving the bandpass-filtered signal from said connecting means and a local oscillator signal, for providing an intermediate-frequency signal to the intermediate-frequency amplifier; and frequency synthesizing means for providing the local oscillator signal at a frequency responsive to carrier frequency selection information from the frequency changing means.

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L2: Entry 2 of 13 File: USPT Jan 27, 2004

DOCUMENT-IDENTIFIER: US 6684076 B2
TITLE: Communique system with hierarchical communique coverage areas in cellular communication networks

Detailed Description Text (12):
The typical implementation of an existing Mobile Telephone Switching Office 106 comprises a Mobile Telephone Switching Office Controller 106C which executes call processing associated with the Mobile Telephone Switching Office 106. A switching network 106 N provides the telephone connectivity between Base Station Subsystems 131-151. Base Station Subsystems 131-151 communicate with wireless subscriber device 101 using Radio Frequency (RF) channels 111 and 112, respectively. RF channels 111 and 112 convey both command messages as well as digital data, which may represent voice signals being articulated at the wireless subscriber device 101 and the far-end party. With a CDMA system, the wireless subscriber device 101 communicates with at least One Base Station Subsystem 131. In FIG. 1, the wireless subscriber device 101 is simultaneously communicating with two Base Station Subsystems 131, 141, thus constituting a soft handoff. However, a soft handoff is not limited to a maximum of two base stations. Standard EIA/TIA IS-95-B supports a soft handoff with as many as six base stations. When in a soft handoff, the base stations serving a given call must act in concert so that commands issued over RF channels 111 and 112 are consistent with each other. In order to accomplish this consistency, one of the serving base station subsystems may operate as the primary base station subsystem with respect to the other serving base station subsystems. Of course, a wireless subscriber device 101 may communicate with only a single base station subsystem if determined as sufficient by the cellular communication network.

Detailed Description Text (13):
Cellular communication networks provide a plurality of concurrently active communications in the same service area, with the number of concurrently active communication connections exceeding the number of available radio channels. This is accomplished by reusing the channels via the provision of multiple Base Station Subsystems 131-151 in the service area that is served by a single Mobile Telephone Switching Office 106. The overall service area of a Mobile Telephone Switching Office 106 is divided into a plurality of "cells", each of which includes a Base Station Subsystem 131 and associated radio transmission tower 102. The radius of the cell is basically the distance from the base station radio transmission tower 102 to the furthest locus at which good reception between the wireless subscriber device 101 and the radio transmission tower 102 can be effected. The entire service area of a Mobile Telephone Switching Office 106 is therefore covered by a plurality of adjacent cells. There is an industry standard cell pattern in which sets of channels are reused. Within a particular cell, the surrounding cells are grouped in a circle around the first cell and the channels used in these surrounding cells differ from the channels used in the particular cell and from each of the other surrounding cells. Thus, the signals emanating from the radio transmission tower in the particular cell do not interfere with the signals emanating from the radio transmission towers located in each of the surrounding cells because they are at different radio frequencies and have different orthogonal coding. However, in the case of soft handoff, the frequencies must be the same for all cells involved in the soft or softer handoff process. In addition, the next closest cell using the

transmission frequency of the particular cell is far enough away from this cell that there is a significant disparity in signal power and therefore sufficient signal rejection at the receivers to ensure that there is no signal interference. The shape of the cell is determined by the surrounding terrain and is typically not circular, but skewed by irregularities in the terrain, the effect of buildings and vegetation and other signal attenuators present in the cell area. Thus, the cell pattern is simply conceptual in nature and does not reflect the actual physical extent on the various cells, since the implemented cells are not hexagonal in configuration and do not have precisely delimited boundary edges.

Detailed Description Text (53):
FIG. 4 illustrates in block diagram form a typical assignment of cells in a cellular communication network for a unidirectional transmission without subscriber registration mode of operation of the present communique system for cellular communication networks 100, where a plurality of cells are transmitting Communique signals, with each cell using the same frequency and optionally the same Walsh (PN) code for a selected Communique. There is a K=3 cell repeat pattern, although alternatively, the cells can be subdivided into three sectors for the same effect. In this manner, the wireless subscriber device 101 does not have to search for the desired Communique, since the location is uniform throughout the cellular communication network. The wireless subscriber device 101 is always in soft handoff mode and in the example of FIG. 4, the PN code varies by cell according to the K=3 repeat pattern, so the wireless subscriber device 101 maintains a soft handoff mode with the three PN codes, regardless of the location of the wireless subscriber device 101 in the cellular communication network. Existing wireless subscriber devices are equipped with three receivers in the rake receiver system that enables operation in this mode.

Detailed Description Text (54):
Alternatively, adjacent cells (or cell sectors) can transmit the Communique signals on different frequencies, but this requires additional complexity in the wireless subscriber device, since the handoff must occur with both frequency and PN code making it a hard handoff. In addition, the lack of uniformity in the transmission frequency requires the wireless subscriber device to receive information from the base station to identify the location of the desired Communique in order to enable the wireless subscriber device to lock on to the appropriate combination of frequency and PN code for each cell. One way of avoiding the complexity is illustrated in FIG. 6 where there is a grouping of K=3 for the cells and the Walsh code assignment is static, using a specific Walsh code for each of the K=3 cells, such as Traffic channel 8 (Walsh code W=8) for the cell K=1 and Traffic channel Ch9 (Walsh code W=9) for the cell K=2 and Traffic channel Ch10 (Walsh code W=10) for cell K=3. Therefore, the subscriber does not need additional information from the cellular communication network to receive the broadcast information, since the wireless subscriber device 101 has 3 RAKE receivers, which can each be locked on to one of the three Walsh codes W=8-W=10 used in the K=3 repeat scenario. The wireless subscriber device 101 can always be in a soft handoff mode to ensure that continual reception of the transmission takes place as the wireless subscriber device 101 receives signals from the three predetermined Traffic channels.

Detailed Description Text (58):
At step 705, the wireless subscriber device 101 registers with the Base Station Subsystem 131 using their unique EIN and SSD, but a common MIN that is used for communique purposes to spoof the base station subsystem 131 into recognizing the wireless subscriber device 101 without requiring a unique identity for the wireless subscriber device 101. In addition, the fraud prevention system (software) in the Mobile Telephone Switching Office 106 is disabled for Communiques since the fraud system rejects multiple simultaneous MINs at different geographic locations. This feature is designed to prevent cloning fraud (more of an artifact for analog versus digital) although multi-MIN fraud detection is used in digital systems as well. The Base Station Subsystem 131 verifies the authorization of this wireless subscriber

device 101 to receive the requested service, identifies the inbound call to the wireless subscriber device 101 (shared by potentially many wireless subscriber devices) at step 706 via the Paging channel used by the wireless subscriber device 101 to request this service and, in response to control signals received by the wireless subscriber device 101 from the Base Station Subsystem 131, the wireless subscriber device 101 at step 707 changes to the identified traffic channel that carries the selected Communique. The wireless subscriber device 101 at step 709 remains in a soft handoff mode to ensure uninterrupted reception of the Communique and also at step 708 outputs the received multi-media data to the user.

Detailed Description Text (61):
The difference with this process compared to that of FIG. 7 is that the registration process of step 705 consists of the wireless subscriber device 101 transmitting the spoofing MIN as well as the SSD and/or ESN to the Base Station Subsystem 131 in a brief data exchange on the reverse CDMA paging channel to log the subscriber in to the selected subscription or toll services. The forward page to the wireless subscriber device 101 can include the Traffic channel identification of the subscribed services and the wireless subscriber device 101 responds on the reverse CDMA channel with the subscriber registration information. Much of the communications to effect soft handoff and registration can be carried in-band on the reverse CDMA channel.

Detailed Description Text (71):
One disadvantage of this particular distributed re-assembly approach is with a CDMA architecture designed to operate in soft or softer handoff (this limitation is not present in an analog or TDMA architecture since they do not operate in soft handoff). Since the data streams must be identical for the wireless subscriber device to operate in soft handoff, as a subscriber transitions form the boundary of one narrowcast region to another, the number of cell sites available to be in soft handoff is varying and could be zero. One method for solving this limited shortcoming is to broadcast the broadband content stream from all sites all the time and put the router function within the wireless subscriber device itself. Commands on how to re-assemble the content is based on an subscribers physical location and the signaling is done on an in-band basis (i.e. the data parsing commands are contained within the traffic channel in a TDM fashion). This reduces the effective available bandwidth for a narrowcast since much of the broadband content is not for a given subscriber and is "thrown" away by a given subscriber. It also places higher computing power at the wireless subscriber device in order to parse the data. Again, if soft handoff is not required for reliable CDMA operation, the aforementioned limitation is not a concern and parsing can be done at the cell site. And, in either parsing scheme, distributed at the cell site or distributed at the wireless subscriber device, if the content is overlaid on an analog or TDMA network, the soft handoff limitation is not an issue.

Detailed Description Text (87):
An example of such a philosophy is presently embodied in the Bluetooth Special Interest Group which uses a wireless paradigm for interoperability of devices using a carrier frequency of between 2,400 MHz and 2,483.5 MHz to support a plurality of data transfer channels, which are either asymmetric or symmetric, as a function of the application that is enabled. The wireless subscriber device includes a radio frequency (RF) transceiver, a baseband link control unit, associated link management control software and an antenna system. The transmitter mixes the baseband information with the frequency hopping local oscillator to generate a frequency modulated carrier. The receiver down converts and demodulates the RF signal using the same oscillator in the adjacent time slot. The transceiver supports both point-to-point and point-to-multi-point connections. A plurality of wireless subscriber devices so enabled can dynamically configure themselves into a "piconet", with one wireless subscriber device designated as the master and the remaining units as slaves. The piconet is distinguished from other similar piconets in the vicinity by the frequency hopping sequence. The baseband protocol can be

used for both circuit and packet switched transmissions. Synchronous links can be established for voice connections, using reserved time slots, while asynchronous links are dedicated for data transmissions.